Solar EUV and X-ray Irradiance

Recent Results and New Prospects

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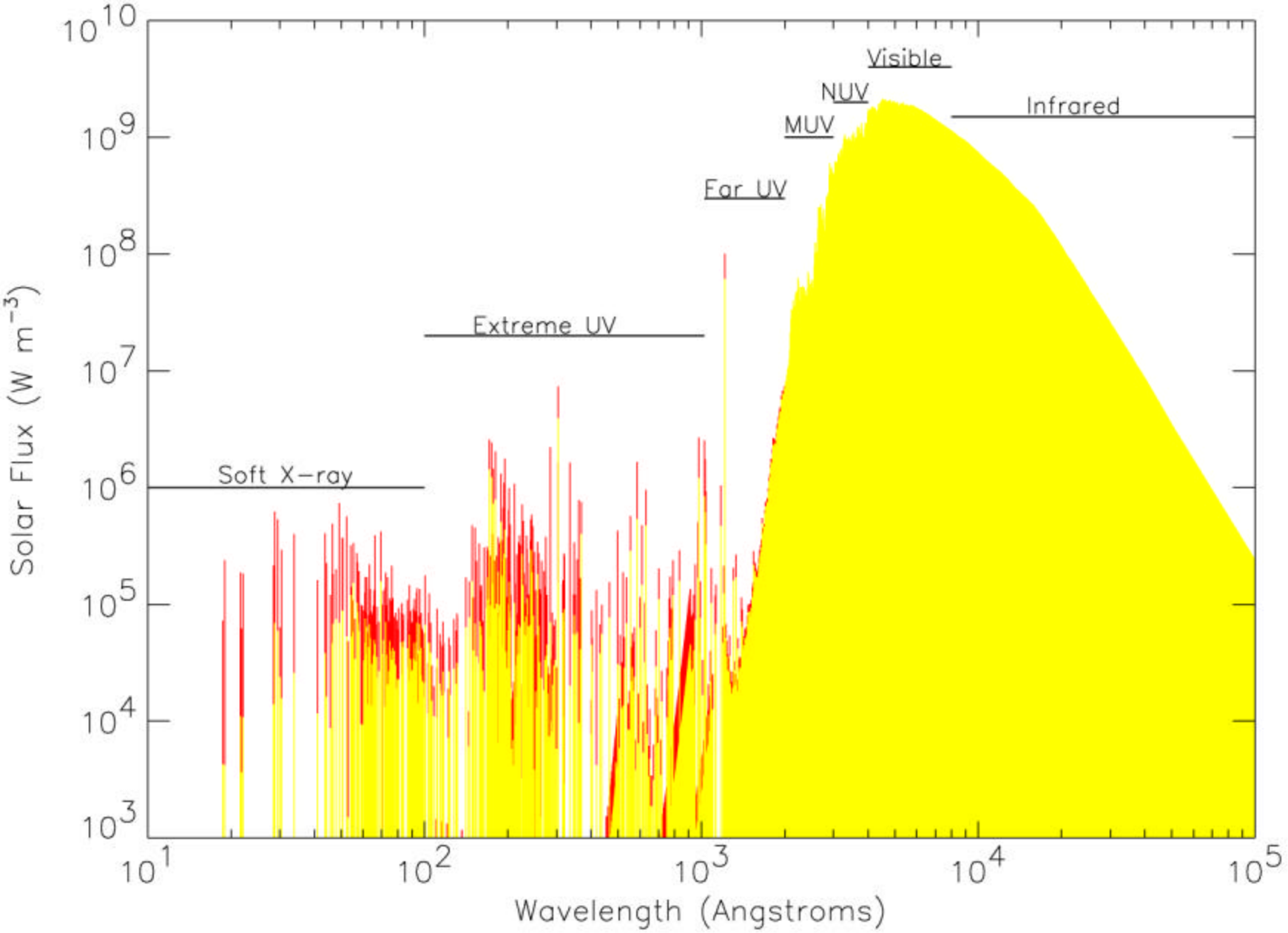
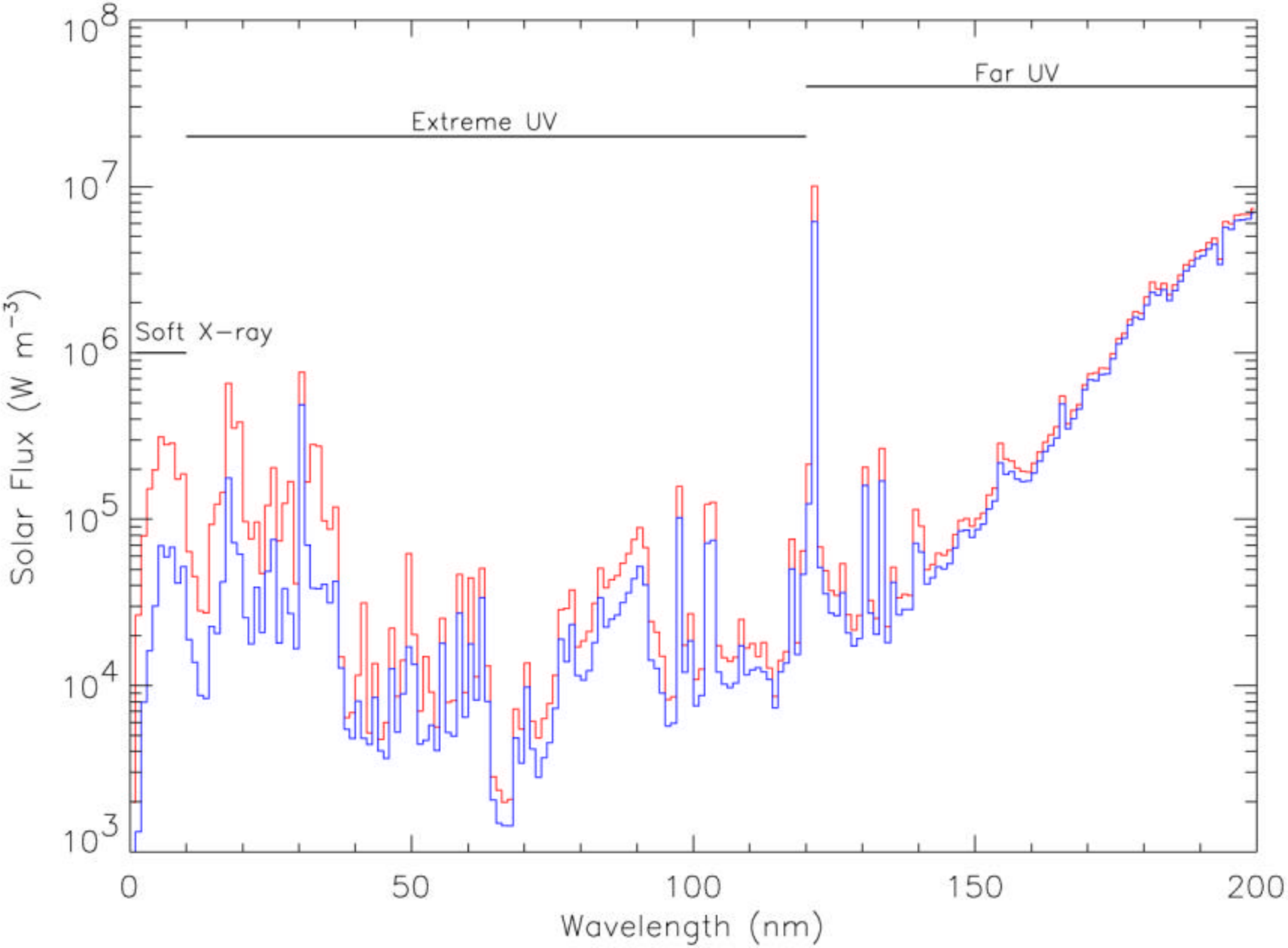
Solar Reference Spectrum

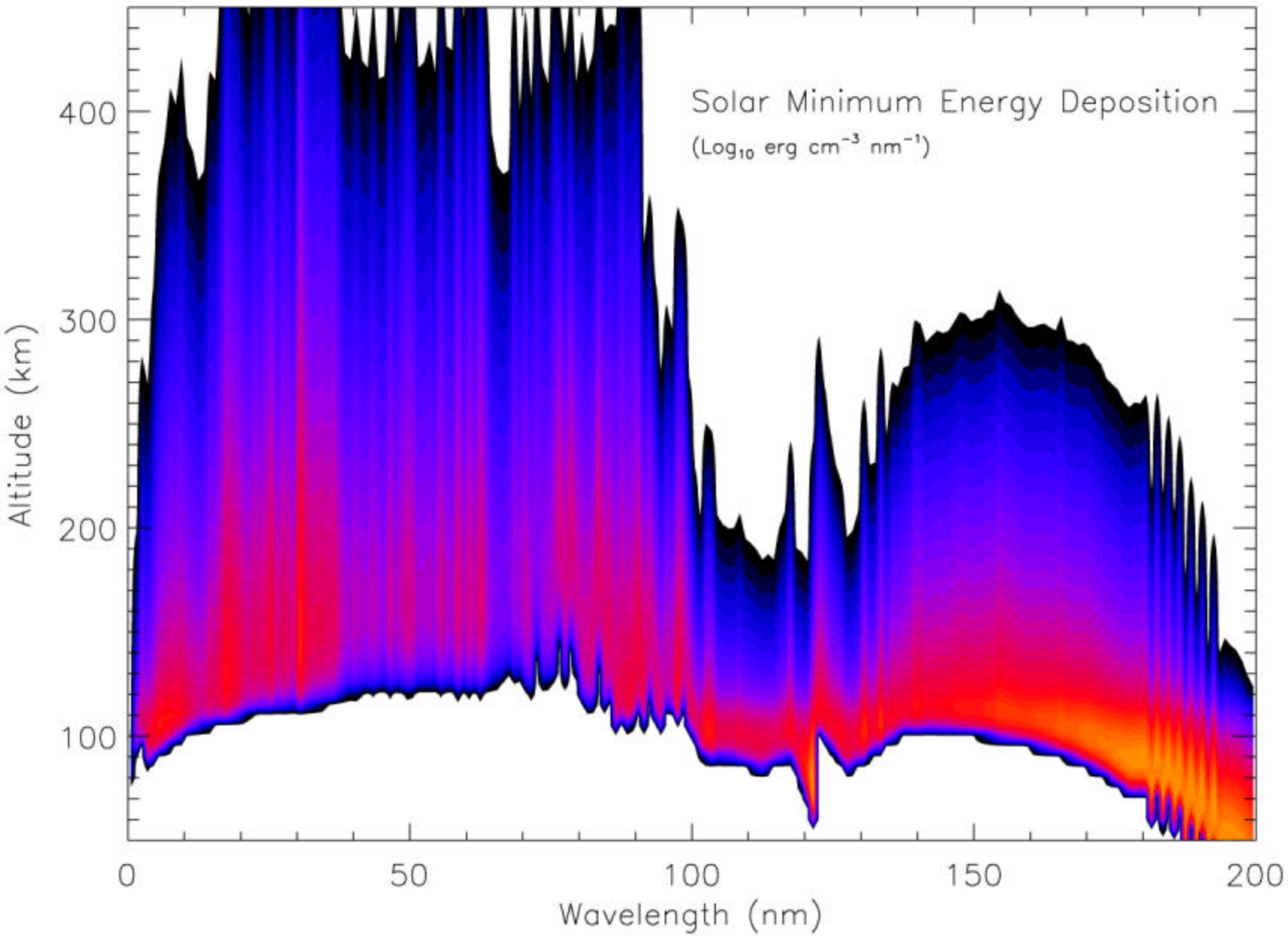


Solar Vacuum-Ultraviolet Reference Spectrum

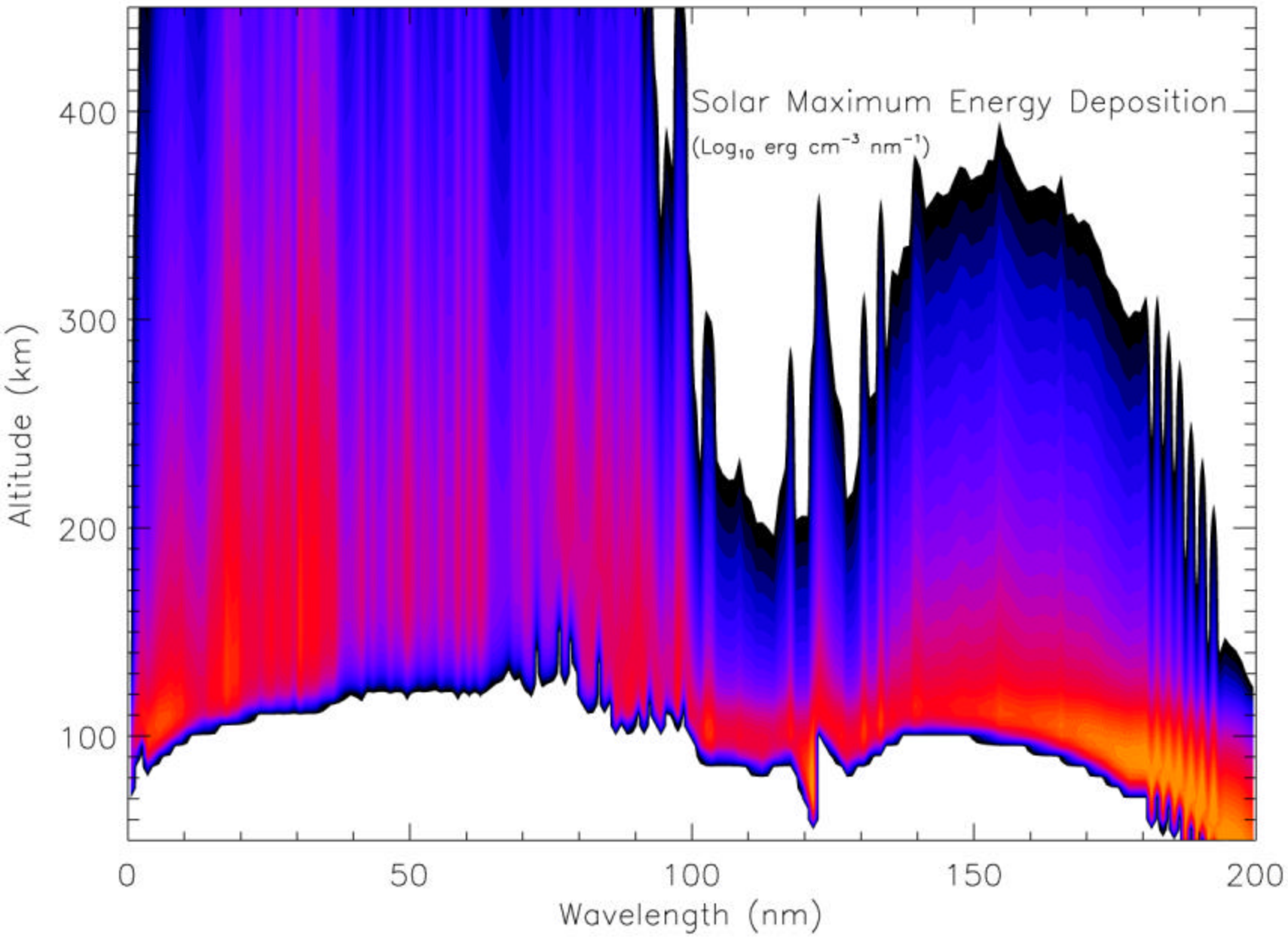


Woods & Rottman.,Comp. Aeron. Sol. Sys., 2002

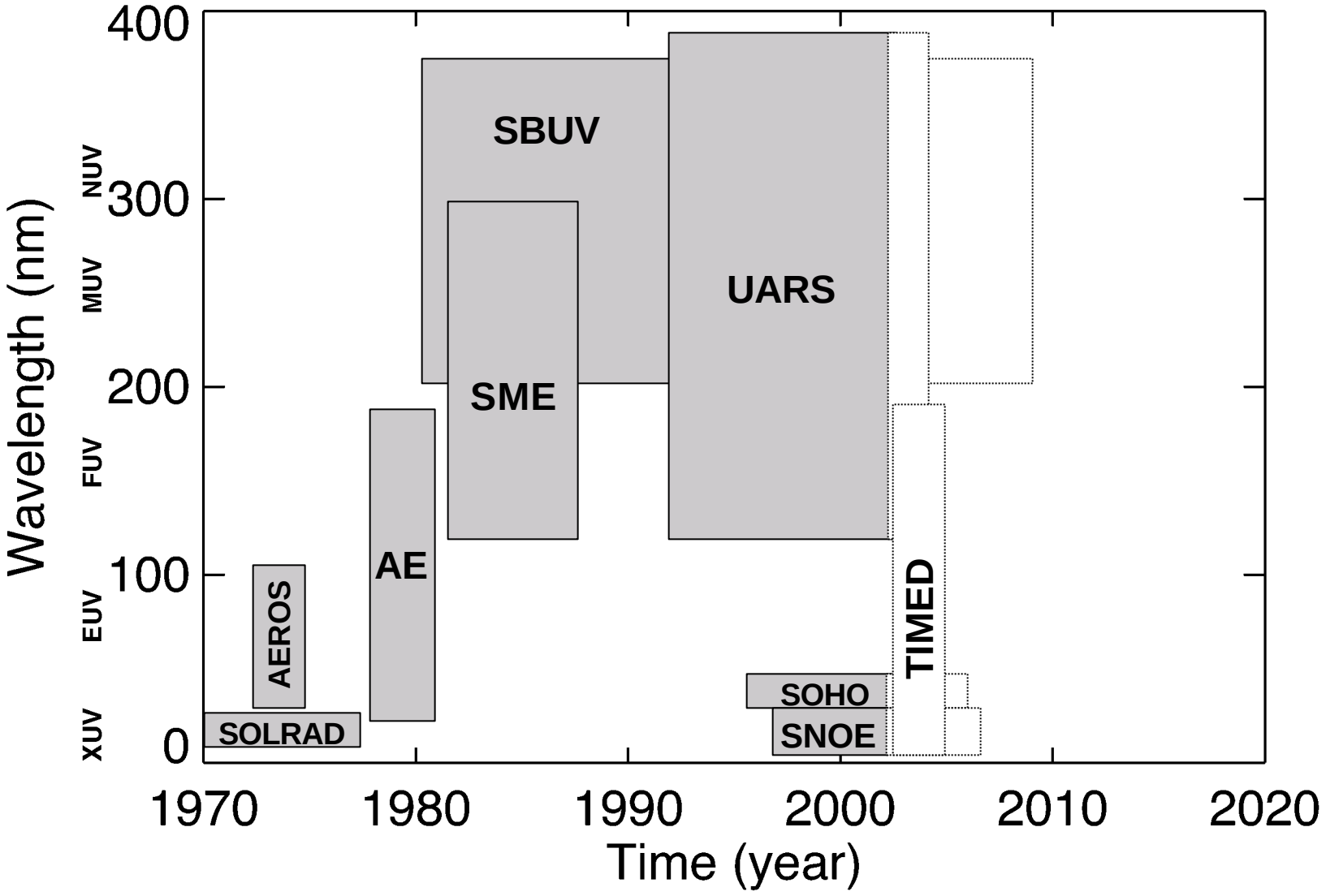
Energy Deposition in the Upper Atmosphere



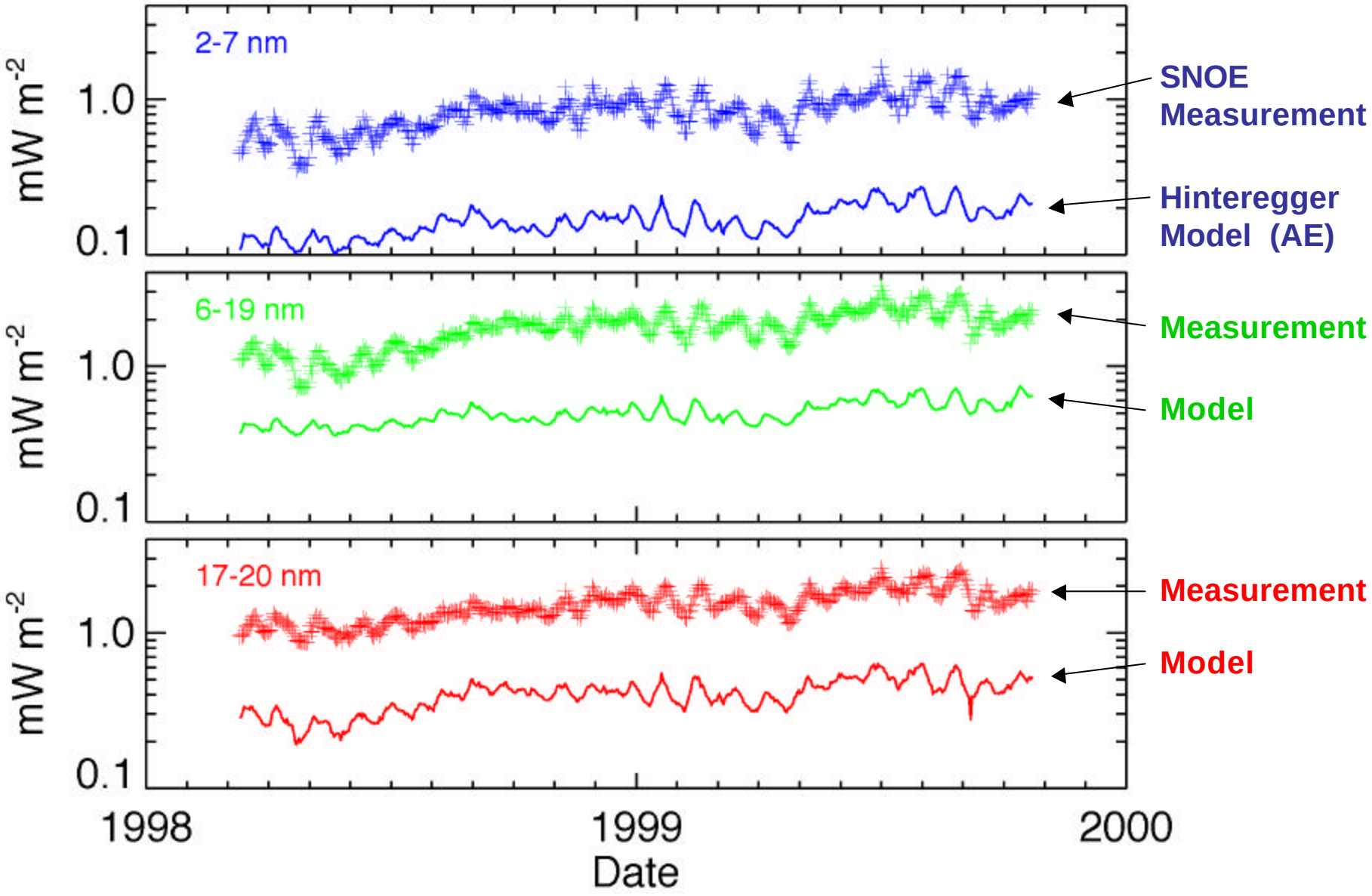
Energy Deposition in the Upper Atmosphere



Solar Ultraviolet Measurements: Past & Present

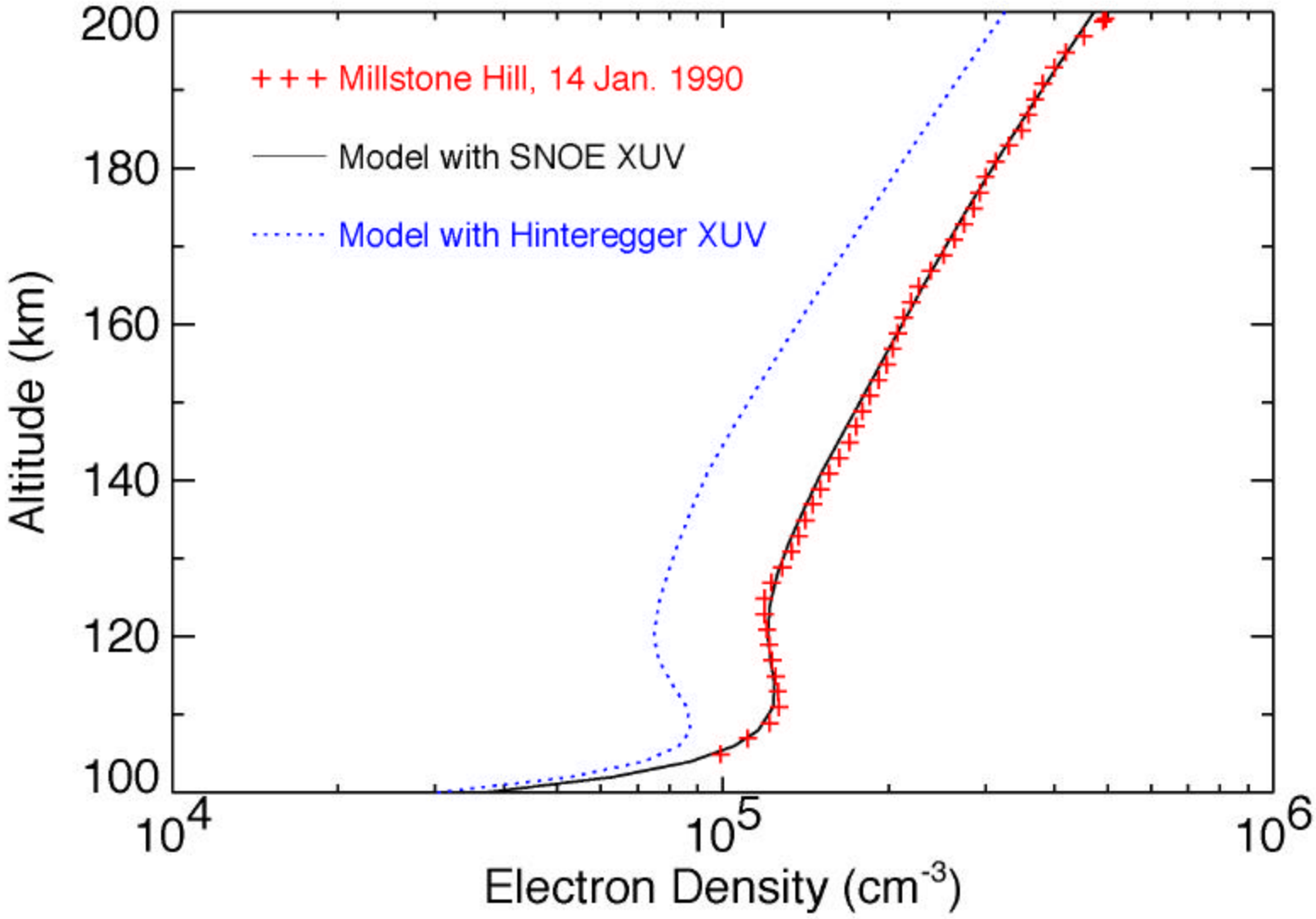


SNOE Solar X-ray Photometer Results



Bailey et al., JGR, 105, 27179, 2000

Electron Density Profile — High Solar Activity

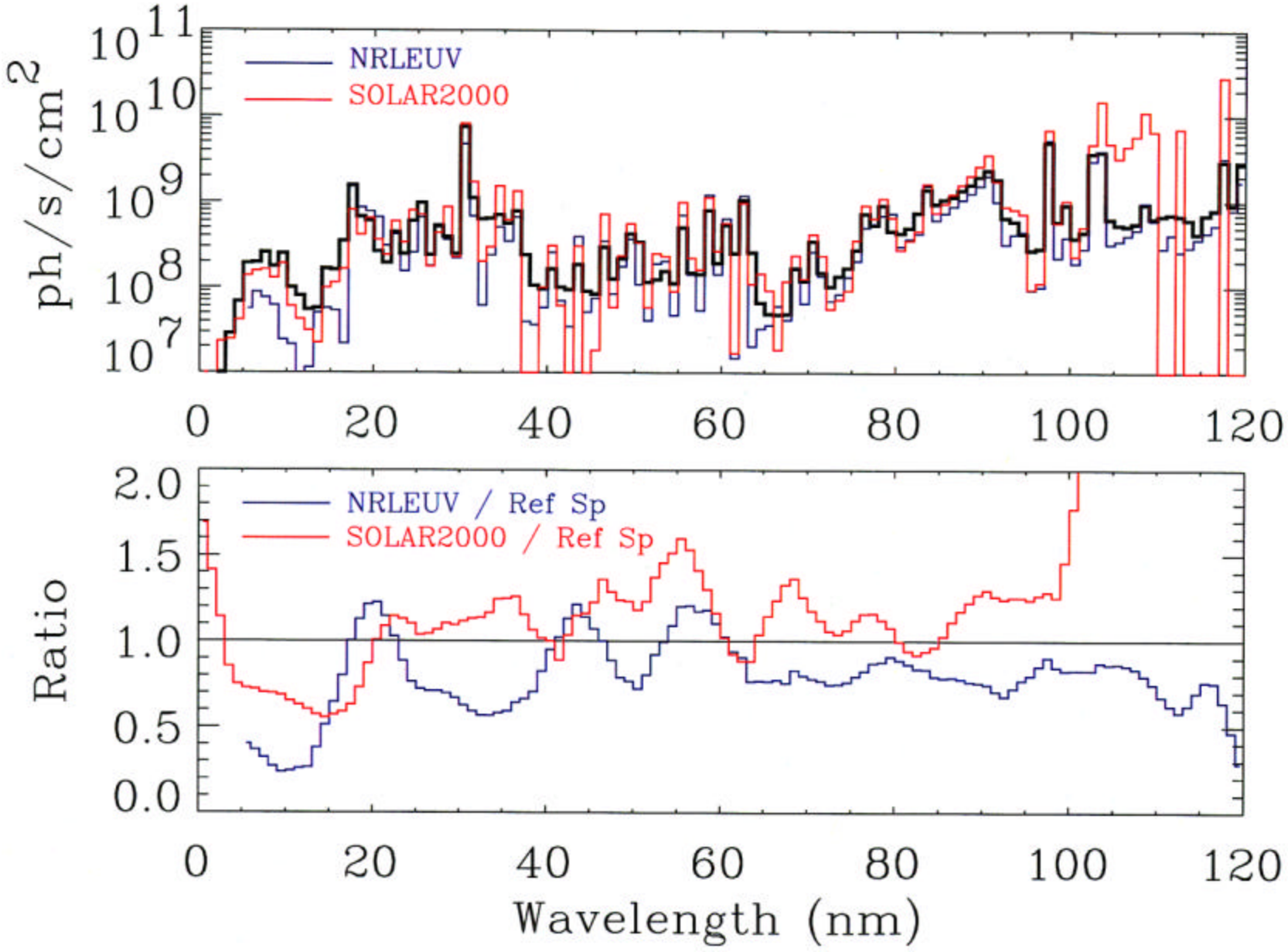


Solomon et al., GRL, 28, 2149, 2001

Atmospheric Effects of Increased XUV Fluxes

- Photoelectrons
  - — *Increased fluxes in lower thermosphere — models match data better*
- Ionization Rates
  - — *Increased in lower ionosphere, mostly due to photoelectron ionization*
- E-region Ion Composition
  - — *Models produce NO^+/O_2^+ >~1, better agreement with measurements*
- Odd-Nitrogen Chemistry
  - — *More production, leads to better agreement with measured NO levels*
- Odd-Oxygen Chemistry
  - — *More variability, remains to be studied*
- Heating Rates
  - — *More variability, but counterbalanced by more NO cooling*

Solar Ultraviolet Models




NASA
TIMED

Priorities for Continuing and Future Solar Ultraviolet Irradiance Measurements

- Extended TIMED mission
  - — *continuing measurements by Solar EUV Experiment*
  - — *need to "see" solar minimum*

- Temporal overlap between TIMED/SEE and GOES/EUV
  - — *needed to correctly interpret GOES/EUV low-resolution channels*
  - — *intercalibration*

- Temporal overlap between UARS, TIMED/SEE and the SORCE mission
  - — *fills EUV gap in SORCE measurements*
  - — *intercalibration*

- Spectrally resolved XUV measurements (1 – 25 nm)
  - — *temporal and spectral overlap with TIMED/SEE and/or GOES/EUV*
  - — *could be frequent sub-orbital, Earth orbit, or L1 (e.g., SDO)*

Some XUV Measurement Techniques

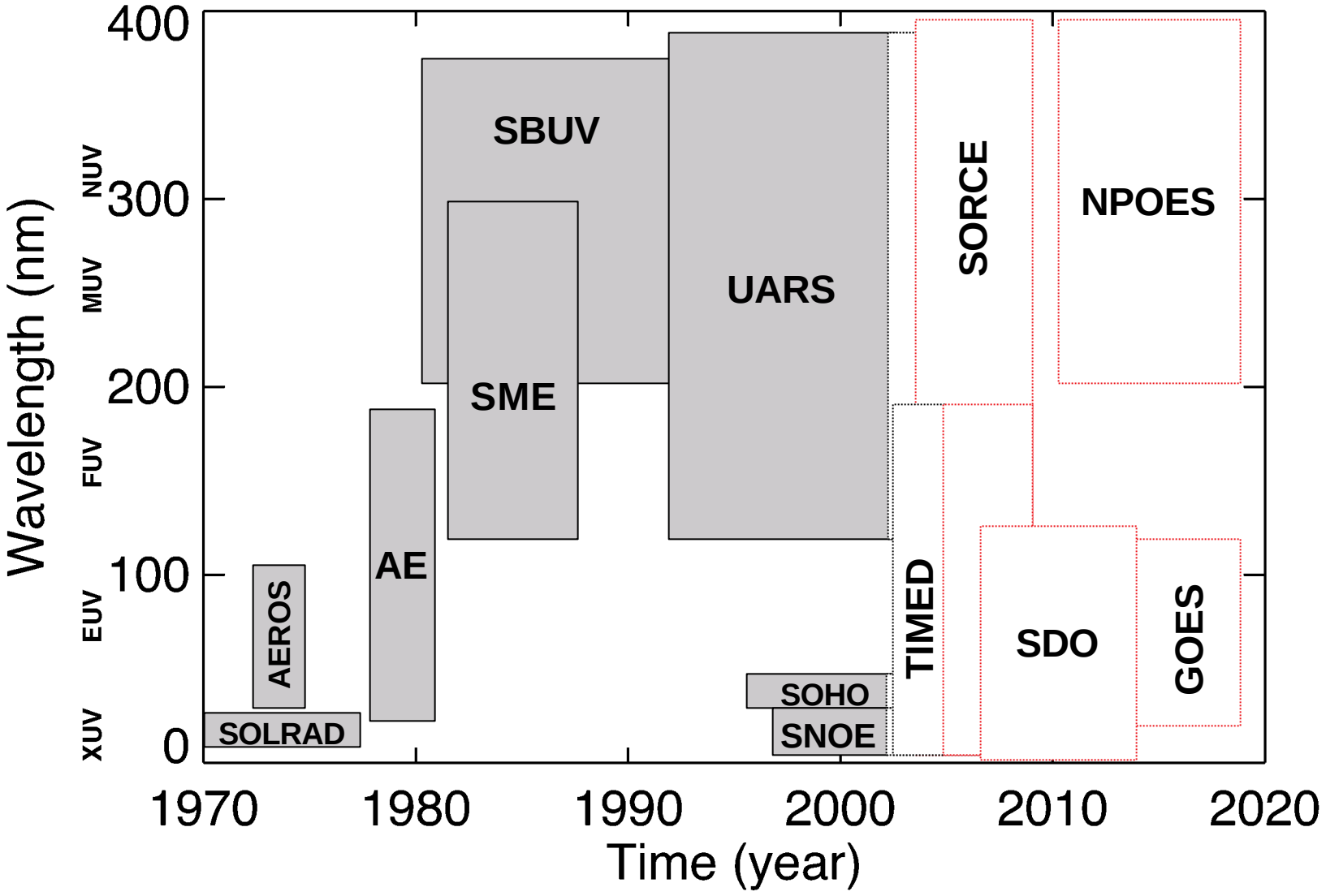
- Detector Standards
  - — *Ionization cell*
  - — *Photodiode with thin-film coatings*

- Optics Free Spectrometers
  - — *Ionization cell in electron-energy mode*
  - — *Avalanche photodiode in photon-counting mode*
  - — *Solid-state detector in photon-counting mode*

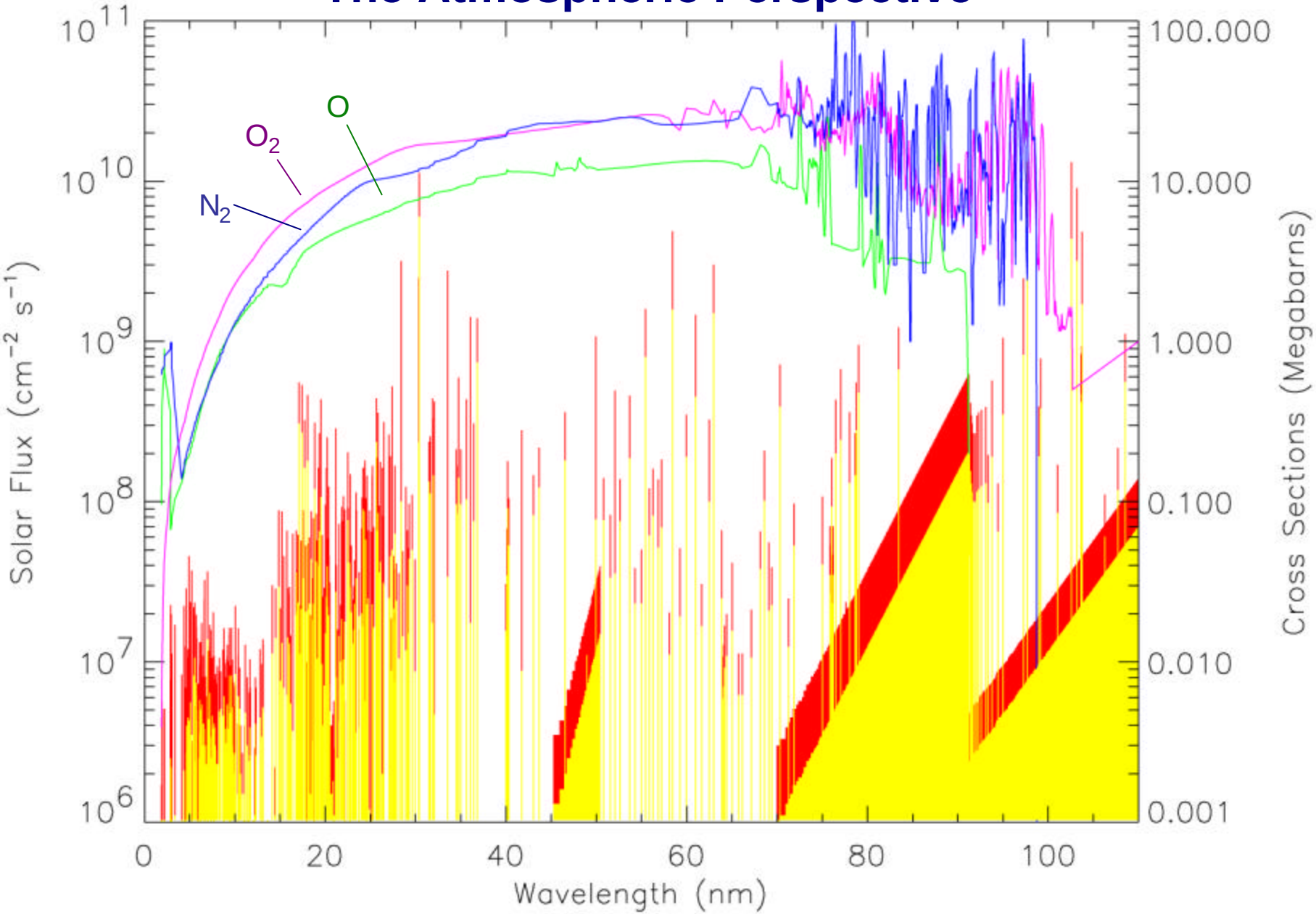
- Grating Spectrometers
  - — *Grazing-incidence grating spectrometer*
  - — *Normal-incidence grating spectrometer with multi-layer coating*

- Bragg Crystal Spectrometer

Solar Ultraviolet Measurements: Past, Present, & Future



Requirements for Spectral Resolution — The Atmospheric Perspective



Requirements for Spectral Resolution — The Atmospheric Perspective

So, what is the necessary spectral resolution for measurements of solar EUV and soft X-rays?

1 nm !

Conclusions

- Significant recent progress on solar soft X-ray and energetic EUV flux (“XUV”)
- Improved agreement with atmospheric models in several areas
- Imminent new solar EUV measurements
- Continuing improvement in solar UV models
- Need for continuing measurements, particularly in areas of greatest uncertainty:
  - — *EUV intensity and variability*
  - — *XUV spectral variability*